U.S. DEPARTMENT OF COMMERCE
National Technical Information Service

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Viking Lake
Montgomery County, Iowa

Corvallis Environmental Research Lab, Oreg

Prepared for

Environmental Monitoring and Support Lab, Las Vegas, Nev

Aug 76

TECHNICAL REPORT DATA

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16. ABSTRACT

Annual total phosphorus and total nitrogen loadings to the lake were estimated and subdivided according to either point or non-point source origin. An assessment of the lake's trophic condition and limiting nutrient is also provided. All data collected by the U.S.E.P.A. National Eutrophication Survey during the one year study of the lake and its tributaries are included in the report.

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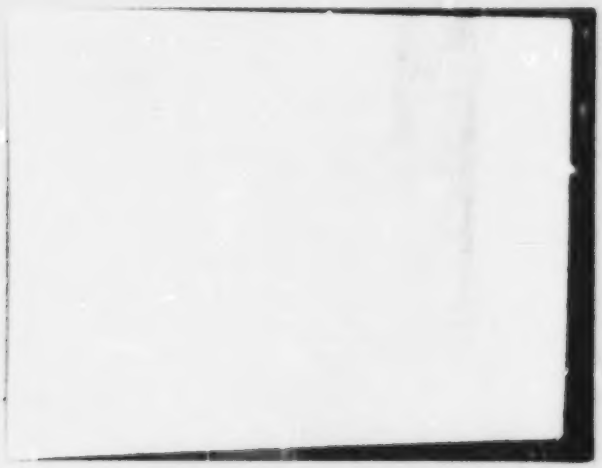
U.S. ENVIRONMENTAL PROTECTION AGENCY
NATIONAL EUTROPHICATION SURVEY

WORKING PAPER SERIES



CORVALLIS ENVIRONMENTAL RESEARCH LABORATORY - CORVALLIS, OREGON

and

ENVIRONMENTAL MONITORING & SUPPORT LABORATORY - LAS VEGAS, NEVADA

P.O. 680-640

REPORT
ON
VIKING LAKE
MONTGOMERY COUNTY
IOWA
EPA REGION VII
WORKING PAPER No. 507

WITH THE COOPERATION OF THE
IOWA DEPARTMENT OF ENVIRONMENTAL QUALITY
AND THE
IOWA NATIONAL GUARD
AUGUST, 1976

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FOREWORD

The National Eutrophication Survey was initiated in 1972 in response to an Administration commitment to investigate the nationwide threat of accelerated eutrophication to freshwater lakes and reservoirs.

OBJECTIVES

The Survey was designed to develop, in conjunction with state environmental agencies, information on nutrient sources, concentrations, and impact on selected freshwater lakes as a basis for formulating comprehensive and coordinated national, regional, and state management practices relating to point-source discharge reduction and non-point source pollution abatement in lake watersheds.

ANALYTIC APPROACH

The mathematical and statistical procedures selected for the Survey's eutrophication analysis are based on related concepts that:

a. A generalized representation or model relating sources, concentrations, and impacts can be constructed.

b. By applying measurements of relevant parameters associated with lake degradation, the generalized model can be transformed into an operational representation of a lake, its drainage basin, and related nutrients.

c. With such a transformation, an assessment of the potential for eutrophication control can be made.

LAKE ANALYSIS

In this report, the first stage of evaluation of lake and watershed data collected from the study lake and its drainage basin is documented. The report is formatted to provide state environmental agencies with specific information for basin planning [§303(e)], water quality criteria/standards review [§303(c)], clean lakes [§314(a,b)], and water quality monitoring [§106 and §305(b)] activities mandated by the Federal Water Pollution Control Act Amendments of 1972.

Beyond the single lake analysis, broader based correlations between nutrient concentrations (and loading) and trophic condition are being made to advance the rationale and data base for refinement of nutrient water quality criteria for the Nation's freshwater lakes. Likewise, multivariate evaluations for the relationships between land use, nutrient export, and trophic condition, by lake class or use, are being developed to assist in the formulation of planning guidelines and policies by EPA and to augment plans implementation by the states.

ACKNOWLEDGMENT

The staff of the National Eutrophication Survey (Office of Research & Development, U. S. Environmental Protection Agency) expresses sincere appreciation to the Iowa Department of Environmental Quality for professional involvement, to the Iowa National Guard for conducting the tributary sampling phase of the Survey, and to those wastewater treatment plant operators who voluntarily provided effluent samples and flow data.

The staff of the Water Quality Division of the Department of Environmental Quality provided invaluable lake documentation and counsel during the Survey, reviewed the preliminary reports, and provided critiques most useful in the preparation of this Working Paper series.

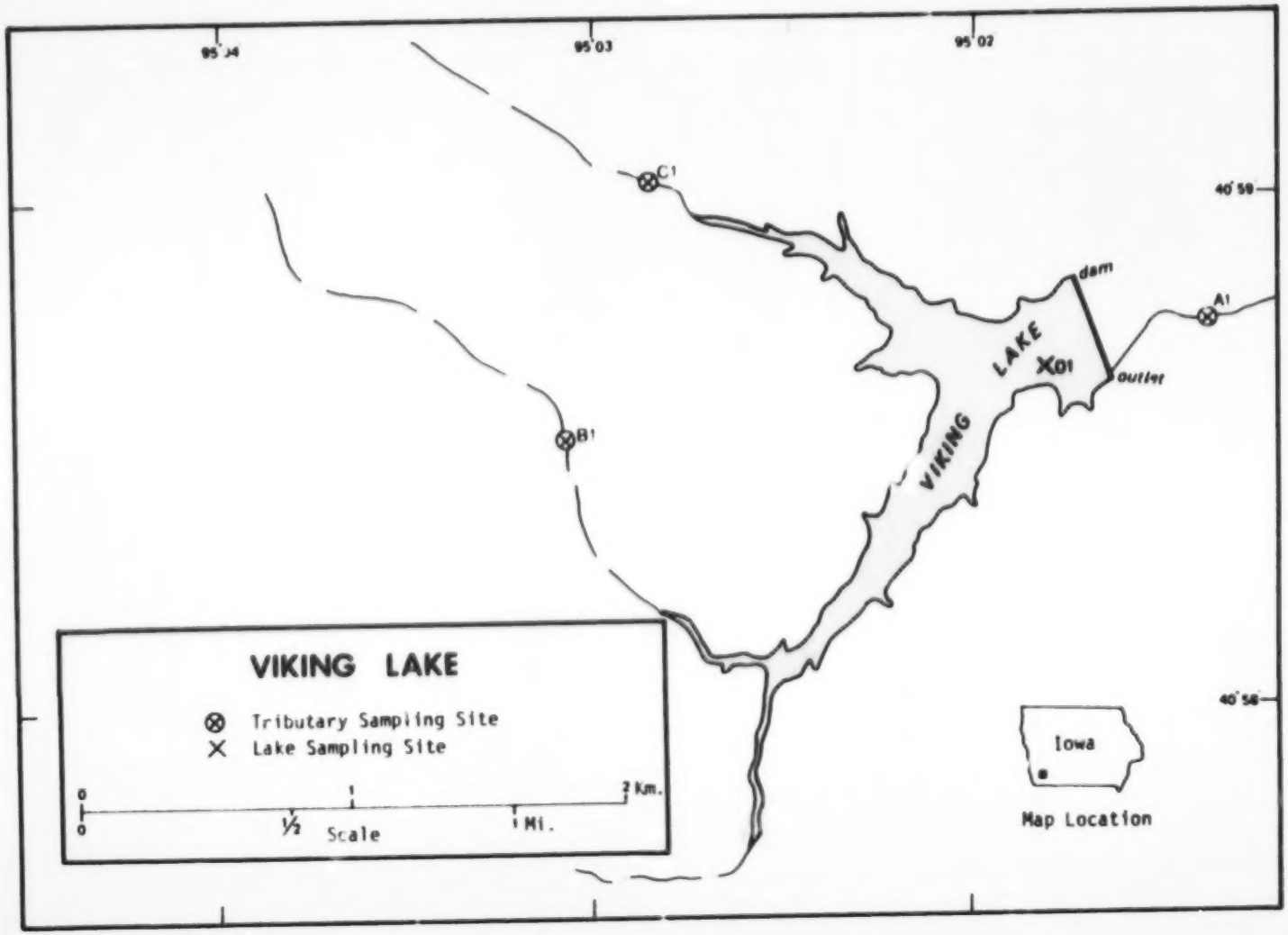
Major General Joseph G. May, the Adjutant General of Iowa, and Project Officer Colonel Cleadeth P. Woods, who directed the volunteer efforts of the Iowa National Guardsmen, are also gratefully acknowledged for their assistance to the Survey.

NATIONAL EUTROPHICATION SURVEY

STUDY LAKES

STATE OF IOWA

LAKE NAME	COUNTY
Ahquabi	Warren
Big Creek Reservoir	Polk
Black Hawk	Sac
Clear	Cerro Gordo
Darling	Washington
Lost Island	Clay, Palo Alto
MacBride	Johnson
Prairie Rose	Shelby
Rathbun Reservoir	Appanoose, Wayne
Red Rock Reservoir	Marion
Rock Creek	Jasper
Silver	Worth
Spirit	Dickinson
Viking	Montgomery
West Okobcji	Dickinson


95°04
95°03
95°02
40°59
40°58
C1
B1
A1
dam
outlet
LAKE
VIKING
X01
VIKING LAKE
Tributary Sampling Site
Lake Sampling Site
0
1
2 Km.
0
½
1 Mi.
Scale
Iowa
Map Location

VIKING LAKE

STORET NO. 1914

I. CONCLUSIONS

A. Trophic Condition:

Survey data indicate that Viking Lake is eutrophic. This lake ranked eleventh in overall trophic quality when the 15 Iowa lakes and reservoirs sampled in 1974 were compared using a combination of six parameters*. Nine of the water bodies had less median total phosphorus, nine had less and one had the same median dissolved phosphorus, four had less and one had the same median inorganic nitrogen, 11 had less mean chlorophyll a, and five had greater mean Secchi disc transparency. Marked depression of dissolved oxygen with depth occurred in July.

The field limnologists noted an algal bloom in the open-water areas in September.

B. Rate-Limiting Nutrient:

There was a significant change in nutrients in the sample from the time of collection to the beginning of the assay. Therefore, the results are not considered representative of conditions in the lake at the time the sample was taken (04/17/74).

The lake data indicate nitrogen limitation in April and September.

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* See Appendix A.

C. Nutrient Controllability:

1. Point sources--There were no known point sources impacting Viking Lake during the sampling year, although lakeshore park facilities may provide direct nutrient inputs to the lake.

The present loading of 0.49 g/m^2/year is somewhat more than that proposed by Vollenweider (Volleweider and Dillon, 1974) as a eutrophic loading (see page 11). However, the present trophic quality probably will be maintained if the phosphorus loading is not increased.

2. Non-point sources--The phosphorus contribution of the gaged tributary amounted to 10.0% of the total load reaching Viking Lake during the sampling year. The estimated phosphorus load from the ungaged drainage areas amounted to 86.7% of the total load; however, the nutrient loads from these areas were estimated using the loads in only one gaged tributary (see page 10), and more data are needed to determine the actual significance of the nutrient contributions.

II. LAKE AND DRAINAGE BASIN CHARACTERISTICS†

A. Lake Morphometry††:

1. Surface area: 0.61 kilometers^2.
2. Mean depth: 5.8 meters.
3. Maximum depth: 12.5 meters.
4. Volume: 3.538×10^6 m^3.
5. Mean hydraulic retention time: 1.6 years.

B. Tributary and Outlet:
(See Appendix C for flow data)

1. Tributaries -

Name	Drainage area (km^2)*	Mean flow (m^3/sec)*
Unnamed Creek B-1	1.0	0.01
Minor tributaries & immediate drainage -	8.7	0.06
Totals	9.7	0.07

2. Outlet -

Unnamed Creek A-1	10.3**	0.07

C. Precipitation***:

1. Year of sampling: 74.2 centimeters.
2. Mean annual: 87.2 centimeters.

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† Table of metric conversions--Appendix B.
†† Harrison, 1975.
* For limits of accuracy, see Working Paper No. 175, "...Survey Methods, 1973-1976".
** Includes area of lake.
*** See Working Paper No. 175.

III. LAKE WATER QUALITY SUMMARY

Viking Lake was sampled three times during the open-water season of 1974 by means of a pontoon-equipped Huey helicopter. Each time, samples for physical and chemical parameters were collected from a number of depths at one station on the lake (see map, page v). During each visit, a single depth-integrated (4.6 m to surface) sample was collected for phytoplankton identification and enumeration; a similar sample was taken for chlorophyll a analysis. During the first visit, a single 18.9 liter depth-integrated sample was collected for algal assays. The maximum depth sampled was 11.0 meters.

The sampling results are presented in full in Appendix D and are summarized in the following table (the July nutrient samples were not preserved properly and were not analyzed).

A. SUMMARY OF PHYSICAL AND CHEMICAL CHARACTERISTICS FOR VIKING LAKE
STORET CODE 1914

PARAMETER	1ST SAMPLING (4/17/74) 1 SITE RANGE	MEAN	MEDIAN	2ND SAMPLING (7/ 2/74) 1 SITE RANGE	MEAN	MEDIAN	3RD SAMPLING (9/25/74) 1 SITE RANGE	MEAN	MEDIAN
TEMP (C)	9.5 - 11.3	10.7	11.0	18.0 - 24.7	23.3	24.6	17.1 - 18.5	17.5	17.3
DISS OXY (MG/L)	10.0 - 10.8	10.3	10.0	6.8 - 7.6	6.8	7.2	6.6 - 8.6	7.2	6.8
CNDCTVY (MCROHO)	64. - 191.	138.	148.	299. - 302.	300.	300.	219. - 225.	220.	219.
PH (STAND UNITS)	------ ----------			7.7 - 8.5	8.3	8.4	7.8 - 8.3	8.0	7.9
TOT ALK (MG/L)	126. - 132.	131.	132.	------ ----------			116. - 120.	118.	117.
TOT P (MG/L)	0.030 - 0.034	0.032	0.032	------ ----------			0.075 - 0.091	0.080	0.077
ORTHO P (MG/L)	0.011 - 0.017	0.014	0.014	------ ----------			0.017 - 0.018	0.018	0.018
NO2+NO3 (MG/L)	0.070 - 0.100	0.090	0.095	------ ----------			0.020 - 0.100	0.062	0.020
AMMONIA (MG/L)	0.060 - 0.070	0.062	0.060	------ ----------			0.060 - 0.120	0.082	0.080
KJEL N (MG/L)	0.780 - 1.000	0.850	0.850	------ ----------			1.000 - 1.500	1.100	1.100
INORG N (MG/L)	0.130 - 0.170	0.152	0.155	------ ----------			0.080 - 0.220	0.124	0.110
TOTAL N (MG/L)	0.790 - 1.070	0.940	0.950	------ ----------			1.020 - 1.520	1.222	1.120
CHLHPYL A (UG/L)	29.8 - 29.8	29.8	29.8	15.4 - 15.4	15.4	15.4	32.9 - 32.9	32.9	32.9
SECCHI (METERS)	0.7 - 0.7	0.7	0.7	1.5 - 1.5	1.5	1.5	0.9 - 0.9	0.9	0.9

B. Biological characteristics:

1. Phytoplankton -

Sampling Date	Dominant Genera	Algal Units per ml
04/17/74	1. Asterionella sp.	49,981
	2. Aphanizomenon sp.	3,617
	3. Flagellates	767
	4. Dinobryon sp.	329
	5. Cryptomonas sp.	219
	Other genera	110
	Total	55,023
07/02/74	1. Fragilaria sp.	1,719
	2. Anabaena sp.	700
	3. Aphanizomenon sp.	641
	4. Cryptomonas sp.	262
	5. Schroederia sp.	233
	Other genera	389
	Total	3,944
09/25/74	1. Coelosphaerium sp.	1,684
	2. Fragellates	1,500
	3. Aphanizomenon sp.	398
	4. Microcystis sp.	184
	5. Anabaena sp.	183
	Other genera	306
	Total	4,255

2. Chlorophyll a -

Sampling Date	Station Number	Chlorophyll a (µg/l)
04/17/74	1	29.8
07/02/74	1	15.4
09/25/74	1	32.9

C. Limiting Nutrient Study:

There was a significant change in nutrients in the algal assay sample from the time of collection to the beginning of the assay. Therefore, the results are not considered representative of conditions in the lake at the time of sampling (04/17/74).

The lake data indicate nitrogen limitation in April and September; i.e., the mean inorganic nitrogen to orthophosphorus ratios were 11 to 1 and 7 to 1, respectively.

IV. NUTRIENT LOADINGS
(See Appendix E for data)

For the determination of nutrient loadings, the Iowa National Guard collected monthly near-surface grab samples from each of the tributary sites indicated on the map (page v), except for the high runoff months of April, May, and June when two samples were collected. Sampling was begun in August, 1974, and was completed in July, 1975.

Through an interagency agreement, stream flow estimates for the year of sampling and a "normalized" or average year were provided by the Iowa District Office of the U.S. Geological Survey for the tributary sites nearest the lake.

In this report, nutrient loads for sampled tributaries were determined by using a modification of a U.S. Geological Survey computer program for calculating stream loadings*.

Nutrient loads for unsampled "minor tributaries and immediate drainage" ("ZZ" of U.S.G.S.) were estimated using the nutrient loads at station B-1, in $kg/km^2/year$, and multiplying by the ZZ area in km^2.

No known point sources impacted Viking Lake during the sampling year.

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* See Working Paper No. 175.

A. Waste Sources:

1. Known municipal - None

2. Known industrial - None

B. Annual Total Phosphorus Loading - Average Year:

1. Inputs -

Source	kg P/ yr	% of total
a. Tributaries (non-point load) -		
Unnamed Stream B-1	30	10.0
b. Minor tributaries & immediate drainage (non-point load) -	260	86.7
c. Known municipal STP's - None	-	-
d. Septic tanks - Unknown	?	-
e. Known industrial - None	-	-
f. Direct precipitation* -	10	3.3
Total	300	100.0

2. Outputs -

Lake outlet - Unnamed Stream A-1 170

3. Net annual P accumulation - 130 kg.

* See Working Paper No. 175.

C. Annual Total Nitrogen Loading - Average Year:

1. Inputs -

Source	kg N/yr	% of total
a. Tributaries (non-point load) -		
Unnamed Stream B-1	385	8.8
b. Minor tributaries & immediate drainage (non-point load) -	3,350	76.2
c. Known municipal STP's - None	-	-
d. Septic tanks - Unknown	?	-
e. Known industrial - None	-	-
f. Direct precipitation* -	660	15.0
Total	4,395	100.0

2. Outputs -

Lake outlet - Unnamed Stream A-1 2,785

3. Net annual N accumulation - 1,610 kg.

D. Non-point Nutrient Export by Subdrainage Area:

Tributary	kg P/km^2/yr	kg N/km^2/yr
Unnamed Stream B-1	30	385

E. Mean Nutrient Concentrations in Ungaged Stream·

Tributary	Mean Total P Conc. (mg/l)	Mean Total N Conc. (mg/l)
Unnamed Stream C-1	0.127	1.513

* See Working Paper No. 175.

F. Yearly Loads:

In the following table, the existing phosphorus loadings are compared to those proposed by Vollenweider (Vollenweider and Dillon, 1974). Essentially, his "dangerous" loading is one at which the receiving water would become eutrophic or remain eutrophic; his "permissible" loading is that which would result in the receiving water remaining oligotrophic or becoming oligotrophic if morphometry permitted. A mesotrophic loading would be considered one between "dangerous" and "permissible".

Note that Vollenweider's model may not be applicable to water bodies with short hydraulic retention times.

	Total Phosphorus		Total Nitrogen	
	Total	Accumulated	Total	Accumulated
grams/m^2/yr	0.49	0.21	7.2	2.6

Vollenweider phosphorus loadings ($g/m^2/yr$) based on mean depth and mean hydraulic retention time of Viking Lake:

"Dangerous" (eutrophic loading)	0.38
"Permissible" (oligotrophic loading)	0.19

V. LITERATURE REVIEWED

Harrison, Harry, 1975. Personal communication (lake morphometry). IA Cons. Comm., Des Moines.

Vollenweider, R. A., and P. J. Dillon, 1974. The application of the phosphorus loading concept to eutrophication research. Natl. Res. Council of Canada Publ. No. 13690, Canada Centre for Inland Waters, Burlington, Ontario.

VI. APPENDICES

APPENDIX A

LAKE RANKINGS

LAKE DATA TO BE USED IN RANKINGS

LAKE CODE	LAKE NAME	MEDIAN TOTAL P	MEDIAN INORG N	500-MEAN SEC	MEAN CHLORA	15-MIN DO	MEDIAN DISS ORTHO P
1901	LAKE ACQUABI	0.062	0.335	464.333	8.600	8.200	0.009
1902	BIG CREEK RESERVOIR	0.044	6.465	438.500	16.867	14.800	0.011
1903	BLACK HAWK LAKE	0.185	0.130	488.167	49.740	15.000	0.020
1904	CLEAR LAKE	0.059	0.070	465.125	17.480	8.600	0.010
1905	LAKE DARLING	0.077	1.475	482.500	13.817	9.200	0.012
1906	LOST ISLAND LAKE	0.146	0.065	421.167	36.180	8.400	0.021
1907	LAKE MACBRIDE	0.061	2.035	458.444	17.067	15.000	0.010
1908	PRAIRIE ROSE LAKE	0.056	0.210	463.667	17.350	8.600	0.010
1909	RATHBUN RESERVOIR	0.071	1.170	475.889	12.039	14.000	0.008
1910	RED ROCK LAKE	0.180	1.880	473.400	14.730	14.000	0.104
1911	ROCK CREEK LAKE	0.065	1.400	480.500	18.367	8.400	0.007
1912	SILVER LAKE	0.193	0.565	482.667	95.380	10.000	0.034
1913	SPIRIT LAKE	0.041	0.090	422.667	12.622	9.000	0.007
1914	VIKING LAKE	0.075	0.130	459.000	26.033	14.200	0.017
1915	WEST LAKE OKOBOJI	0.046	0.060	380.444	7.722	15.000	0.017

PERCENT OF LAKES WITH HIGHER VALUES (NUMBER OF LAKES WITH HIGHER VALUES)

LAKE CODE	LAKE NAME	MEDIAN TOTAL P	MEDIAN INORG N	500-MEAN SEC	MEAN CHLORA	15-MIN DO	MEDIAN DISS ORTHO P	INDEX NO
1901	LAKE ACQUABI	57 (8)	50 (7)	43 (6)	93 (13)	100 (14)	79 (11)	422
1902	BIG CREEK RESERVOIR	89 (12)	0 (0)	79 (11)	57 (8)	21 (3)	50 (7)	296
1903	BLACK HAWK LAKE	7 (1)	68 (9)	0 (0)	7 (1)	7 (0)	21 (3)	110
1904	CLEAR LAKE	71 (10)	86 (12)	50 (7)	36 (5)	75 (10)	64 (8)	382
1905	LAKE DARLING	29 (4)	21 (3)	14 (2)	71 (10)	57 (8)	43 (6)	235
1906	LOST ISLAND LAKE	21 (3)	93 (13)	93 (13)	14 (2)	89 (12)	14 (2)	324
1907	LAKE MACBRIDE	64 (9)	7 (1)	71 (10)	50 (7)	7 (0)	64 (8)	263
1908	PRAIRIE ROSE LAKE	79 (11)	57 (8)	57 (8)	43 (6)	75 (10)	64 (8)	375
1909	RATHBUN RESERVOIR	43 (6)	36 (5)	29 (4)	86 (12)	39 (5)	86 (12)	319
1910	RED ROCK LAKE	14 (2)	14 (2)	36 (5)	64 (9)	39 (5)	0 (0)	167
1911	ROCK CREEK LAKE	50 (7)	29 (4)	21 (3)	29 (4)	89 (12)	96 (13)	314
1912	SILVER LAKE	0 (0)	43 (6)	7 (1)	0 (0)	50 (7)	7 (1)	107
1913	SPIRIT LAKE	100 (14)	79 (11)	86 (12)	79 (11)	64 (9)	96 (13)	504
1914	VIKING LAKE	36 (5)	64 (9)	64 (9)	21 (3)	29 (4)	32 (4)	250
1915	WEST LAKE OKOBOJI	89 (12)	100 (14)	100 (14)	100 (14)	7 (0)	32 (4)	428

LAKES RANKED BY INDEX NOS.

RANK	LAKE CODE	LAKE NAME	INDEX NO
1	1913	SPIRIT LAKE	504
2	1915	WEST LAKE OKOBOJI	428
3	1901	LAKE ACQUABI	422
4	1904	CLEAR LAKE	382
5	1908	PRAIRIE ROSE LAKE	375
6	1906	LOST ISLAND LAKE	324
7	1909	RATHBUN RESERVOIR	319
8	1911	ROCK CREEK LAKE	314
9	1902	BIG CREEK RESERVOIR	296
10	1907	LAKE MACBRIDE	263
11	1914	VIKING LAKE	250
12	1905	LAKE DARLING	235
13	1910	RED ROCK LAKE	167
14	1903	BLACK HAWK LAKE	110
15	1912	SILVER LAKE	107

APPENDIX B

CONVERSION FACTORS

CONVERSION FACTORS

Hectares x 2.471 = acres

Kilometers x 0.6214 = miles

Meters x 3.281 = feet

Cubic meters x 8.107×10^{-4} = acre/feet

Square kilometers x 0.3861 = square miles

Cubic meters/sec x 35.315 = cubic feet/sec

Centimeters x 0.3937 = inches

Kilograms x 2.205 = pounds

Kilograms/square kilometer x 5.711 = lbs/square mile

APPENDIX C

TRIBUTARY FLOW DATA

TRIBUTARY FLOW INFORMATION FOR IOWA 12/23/75

LAKE CODE 1914 VIKING LAKE

TOTAL DRAINAGE AREA OF LAKE(SQ KM) 10.3

TRIBUTARY	SUB-DRAINAGE AREA(SQ KM)	NORMALIZED FLOWS(CMS) JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	MEAN
1914A1	10.3	0.03	0.04	0.10	0.05	0.08	0.31	0.05	0.04	0.06	0.02	0.03	0.02	0.07
1914B1	1.0	0.00	0.00	0.01	0.01	0.01	0.03	0.00	0.00	0.01	0.00	0.00	0.00	0.01
1914Z2	9.3	0.02	0.04	0.09	0.05	0.07	0.28	0.04	0.04	0.06	0.02	0.02	0.01	0.06

SUMMARY

TOTAL DRAINAGE AREA OF LAKE = 10.3
SUM OF SUB-DRAINAGE AREAS = 10.3
TOTAL FLOW IN = 0.83
TOTAL FLOW OUT = 0.83

MEAN MONTHLY FLOWS AND DAILY FLOWS(CMS)

TRIBUTARY	MONTH	YEAR	MEAN FLOW	DAY	FLOW	DAY	FLOW	DAY	FLOW
1914A1	8	74	0.0	17	0.0				
	9	74	0.00	6	0.00				
	10	74	0.00	6	0.00				
	11	74	0.00	3	0.00				
	12	74	0.00	16	0.00				
	1	75	0.00	6	0.00				
	2	75	0.01	8	0.02				
	3	75	0.12	8	0.02				
	4	75	0.06	6	0.06				
	5	75	0.02	4	0.03				
	6	75	0.05	6	0.01				
	7	75	0.01	9	0.02				
1914B1	8	74	0.0	17	0.0				
	9	74	0.0	6	0.0				
	10	74	0.0	6	0.0				
	11	74	0.0	3	0.0				
	12	74	0.0	16	0.0				
	1	75	0.0	6	0.0				
	2	75	0.00	8	0.00				
	3	75	0.01	8	0.00				
	4	75	0.01	6	0.01				
	5	75	0.00	4	0.00				
	6	75	0.01	6	0.00				
	7	75	0.00	9	0.00				
1914Z2	8	74	0.0						
	9	74	0.00						
	10	74	0.00						
	11	74	0.00						
	12	74	0.00						
	1	75	0.00						
	2	75	0.01						
	3	75	0.12						
	4	75	0.06						
	5	75	0.02						
	6	75	0.05						
	7	75	0.01						

APPENDIX D

PHYSICAL and CHEMICAL DATA

STORET RETRIEVAL DATE 76/01/26

191401
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VIKING LAKE
32027 IOWA

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2111202
0020 FEET DEPTH

DATE FROM TO	TIME OF DAY	DEPTH FEET	00010 WATER TEMP CENT	00300 DO MG/L	00077 TRANSP SECCHI INCHES	00094 CNDUCTVY FIELD MICROMHO	00400 PH SU	00410 T ALK CACO3 MG/L	00610 NH3-N TOTAL MG/L	00625 TOT KJEL N MG/L	00630 NO2&NO3 N-TOTAL MG/L	00671 PHOS-DIS ORTHO MG/L P
74/04/17	15 05	0000	11.3		29	64		132	0.060	1.000	0.070	0.017
	15 05	0005	11.3	10.8		188		132	0.060	0.700	0.090	0.012
	15 05	0015	10.8	10.8		188		132	0.060	0.900	0.100	0.011
	15 05	0025	9.5	10.0		191		126	0.070	0.800	0.100	0.017
74/07/02	13 45	0000	24.7	[illegible]	60	302	8.50					
	13 45	0005	24.7	[illegible]		300	8.40					
	13 45	0010	24.6	7.2		300	8.40					
	13 45	0020	24.5	7.0		299	8.30					
	13 45	0025	18.0	0.8		299	7.70					
74/09/25	14 10	0000	18.5	8.6	34	225	8.33	120	0.060	1.500	0.020	0.018
	14 10	0005	17.6	7.2		219	8.01	117	0.060	1.300	0.050	0.018
	14 10	0015	17.3	6.8		219	7.93	116	0.080	1.100	0.020	0.018
	14 10	0025	17.2	6.6		219	7.89	116	0.090	1.000	0.020K	0.017
	14 10	0036	17.1	6.6		219	7.85	120	0.120	1.000	0.100	0.018

DATE FROM TO	TIME OF DAY	DEPTH FEET	00665 PHOS-TOT MG/L P	32217 CHLRPHYL A UG/L	00031 INCDT LT RFMNING PERCENT
74/04/17	15 05	0000	0.034	29.8	
	15 05	0005	0.032		
	15 05	0015	0.033		
	15 05	0025	0.030		
74/07/02	13 45	0000		15.4	
74/09/25	14 10	0000	0.091	32.9	
	14 10	0003			1.0
	14 10	0005	0.082		
	14 10	0015	0.075		
	14 10	0025	0.077		
	14 10	0036	0.077		

K VALUE KNOWN TO BE
LESS THAN INDICATED

APPENDIX E

TRIBUTARY DATA

STORET RETRIEVAL DATE 76/01/27

1914A1
40 59 00.0 095 02 00.0
UNNAMED CREEK
19059 MONTGOMERY CO MP
O/VIKING LAKE
MED DTY RD BRDG AT W EDGE VIKING LK PARK
11EPALES 2111204
4 0000 FEET DEPTH

DATE FROM TO	TIME OF DAY	DEPTH FEET	00630 NO2&NO3 N-TOTAL MG/L	00625 TOT KJEL N MG/L	00610 NH3-N TOTAL MG/L	00671 PHOS-DIS ORTHO MG/L P	00665 PHOS-TOT MG/L P
74/08/17	10 30		0.016	0.900	0.015	0.040	0.145
74/09/06	19 00		0.024	0.600	0.015	0.030	0.065
74/10/06	09 10		0.008	1.100	0.030	0.045	0.045
74/11/03	09 30		0.016	0.800	0.040	0.045	0.090
74/12/16	12 00		0.200	0.600	0.090	0.012	0.040
75/01/06	17 15		0.016	0.700	0.056	0.015	0.110
75/02/22	17 00		0.015	0.900	0.224	0.008	0.080
75/03/08	14 35		0.250	2.500	0.330	0.040	0.260
75/04/06	17 15		0.115	1.400	0.035	0.025	0.060
75/04/24	16 00		0.015	0.750	0.025	0.010	0.050
75/05/04	09 30		0.025	0.750	0.040	0.037	0.050
75/05/20	17 10		0.030	0.800	0.045	0.045	0.150
75/06/06	17 00		0.020	0.900	0.025	0.045	0.120
75/06/28	08 45		0.065	1.350	0.035	0.015	0.070
75/07/09	18 00		0.025	0.850	0.105	0.035	0.090

STORET RETRIEVAL DATE 76/01/27

191481
40 58 40.0 095 03 00.0
UNNAMED CREEK
19 MONTGOMERY CO MP
T/VIKING LAKE
VIKING LK PRK RD CLVRT 3 MI E OF STANTON
11EPALES 2111204
4 0000 FEET DEPTH

DATE FROM TO	TIME OF DAY	DEPTH FEET	00630 NO2&NO3 N-TOTAL MG/L	00625 TOT KJEL N MG/L	00610 NH3-N TOTAL MG/L	00671 PHOS-DIS ORTHO MG/L P	00665 PHOS-TOT MG/L P
74/11/03	09 15		0.672	2.100	0.115	0.130	0.310
75/01/06	18 00		1.160	1.400	0.368	0.095	0.140
75/04/06	16 45		1.300	0.750	0.032	0.090	0.130
75/04/24	16 30		0.060	0.750	0.030	0.125	0.180
75/05/04	10 30		0.375	0.750	0.110	0.060	0.120
75/05/20	17 30		0.300	2.600	0.075	0.110	0.420
75/06/06	17 30		0.002	2.000	0.035	0.070	0.110
75/06/28	09 15		0.480	0.825	0.070	0.130	0.220

STORET RETRIEVAL DATE 76/01/27

1914C1
40 59 20.0 095 02 50.0
UNNAMED CREEK
19 MONTGOMERY CO MP
T/VIKING LAKE
HWY 34 CULVERT 3.0 MI E OF STANTON
11EPALES 2111204
4 0000 FEET DEPTH

DATE FROM TO	TIME OF DAY	DEPTH FEET	00630 NO2&NO3 N-TOTAL MG/L	00625 TOT KJEL N MG/L	00610 NH3-N TOTAL MG/L	00671 PHOS-DIS ORTHO MG/L P	00665 PHOS-TOT MG/L P
75/01/06	17 45		0.072	1.200	0.064	0.010	0.030
75/02/22	17 15		0.200	0.900	0.080	0.008	0.020
75/03/08	14 30		0.490	1.130	0.180	0.010	0.030
75/04/06	17 05		0.260	0.900	0.040	0.010	0.060
75/04/24	16 15		0.950	1.650	0.315	0.045	0.150
75/05/04	09 45		0.080	0.650	0.095	0.010	0.020
75/05/20	17 20		0.020	2.700	0.045	0.087	0.460
75/06/06	17 15		0.095		0.055	0.055	0.150
75/06/28	09 00		0.005	1.100	0.035	0.070	0.160
75/07/09	18 30		0.010	1.300	0.095	0.075	0.190